Ford Comments for HEI Sponsors' Meeting

March 4th, 2019

Protecting Health and the Environment

"Sustainable economic development is important to the future welfare of the Company, as well as to that of society in general. To be sustainable, economic development must provide for protection of human health and the world's environmental resource base. It is Ford's policy that its operations, products, and services accomplish their functions in a manner that provides responsibly for protection of health and the environment."

Source: Ford Policy Letter No. 17 Protecting Health and the Environment

HEI is a Valued Partner

HEI provides an extremely valuable service to society (public, industry, regulators, academia) by providing high-quality assessments of the health impacts of vehicle emissions.

We recognize HEI addresses complex and contentious issues. We have tremendous respect for the manner in which HEI has performed its work. HEI leadership staff are world class. HEI is a national asset.

Since HEI was chartered (1980), game changing reductions in vehicle tailpipe emissions and improvements in air quality.

On-Road Emission Measurements

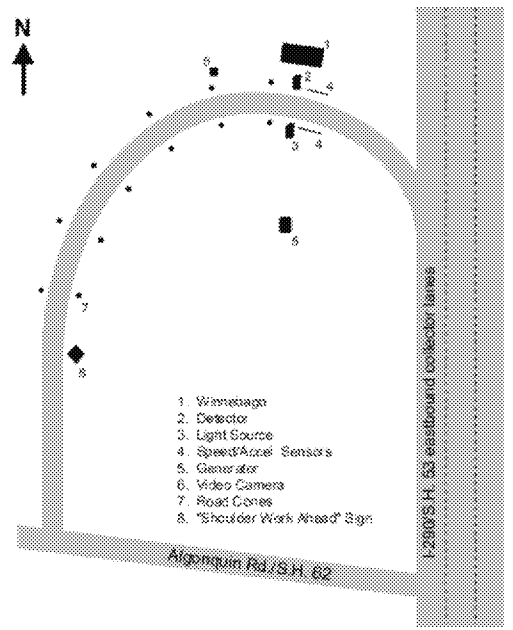
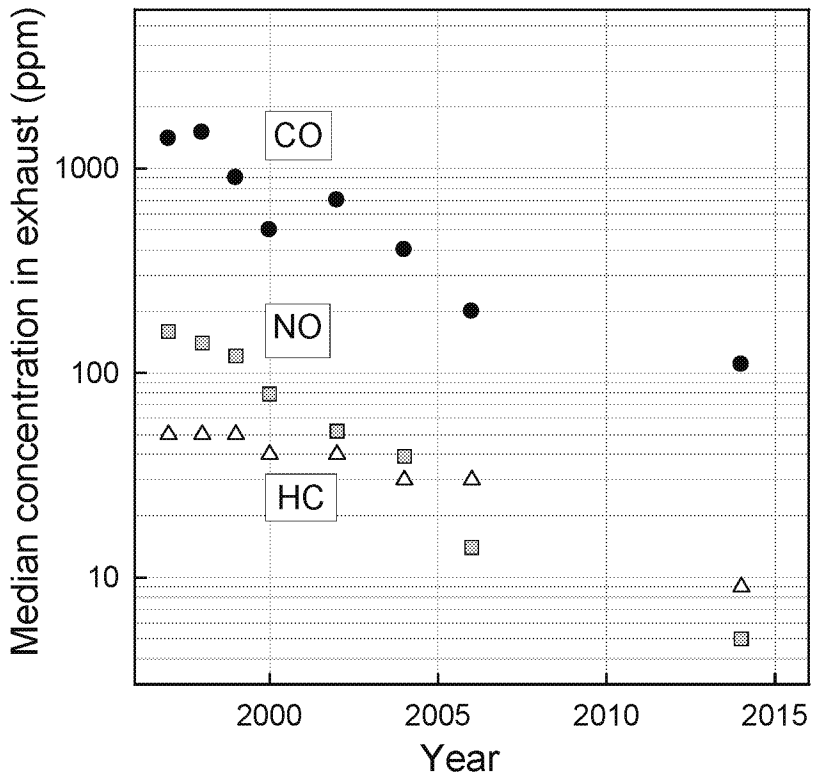


Figure 1. Area map of the on-ramp from Algonquin Road to eastbound I-290 in northwest Chi showing remote sensor configuration and safety equipment.

Non-dispersive IR spectroscopic monitoring of CO, CO_2, and HCs and dispersive UV spectroscopic monitoring of NO and NO_2, SO_2 and NH_3. Measurements conducted in 1997, 1998, 1999, 2000, 2002, 2004, 2006, and 2014. Approximately 20,000 vehicles measured in each study.

Data source: G.A. Bishop, D.H. Stedman, On-Road Remote Sensing of Automobile Emissions in the Chicago Area: Fall 2014, CRC Report E-106 (2015).

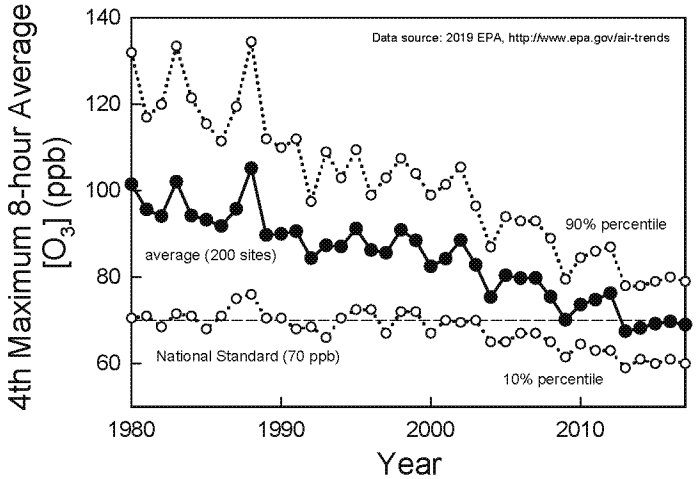
Tailpipe Emissions Reductions

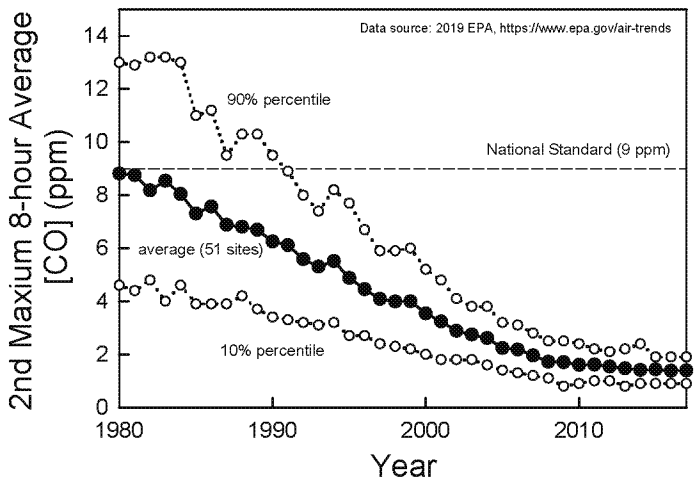


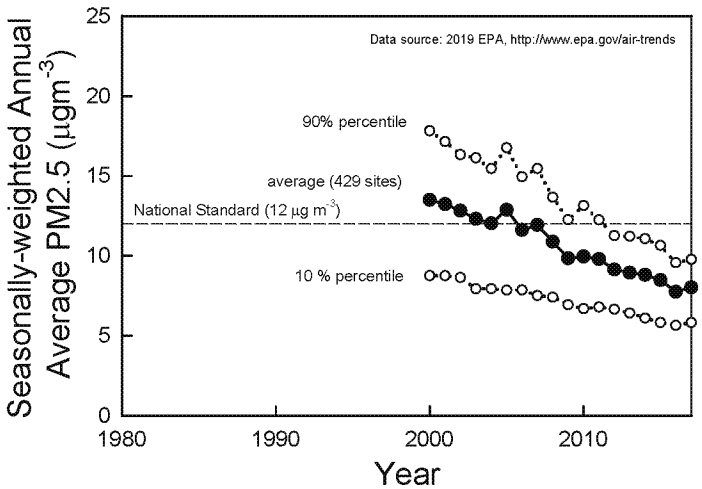
Game changing reductions in CO, NO, HC vehicle emissions.

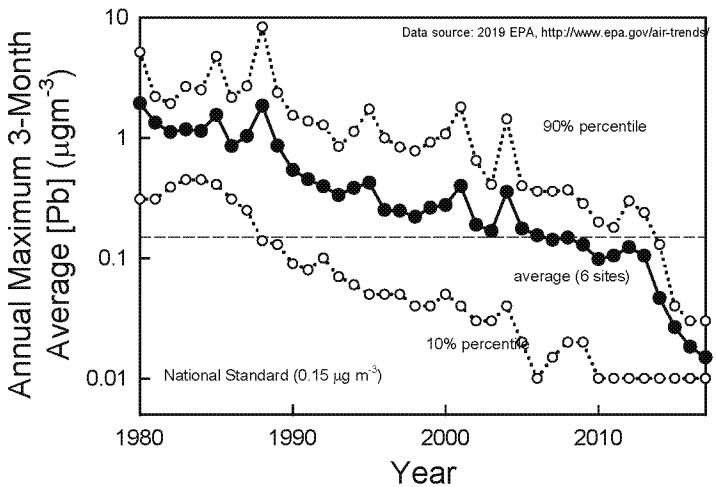
Data sources: Left, 1957–1967 and 1967–1971 are emissions measured for on-road U.S. fleet from Fegraus et al SAE 730530 (1973) The data for 1975–2025 are the California, and Federal U.S. regulatory requirements. Right: G.A. Bishop, D.H. Stedman, On-Road Remote Sensing of Automobile Emissions in the Chicago Area: Fall 2014, CRC Report E-106 (2015).

U.S. Air Quality: O_3, CO, PM2.5, Pb, …









Game-changing improvement in air quality (despite greatly increased VMT).

Future Research

Ford requests future HEI work in two areas

- Accountability studies

- Impacts of exposure to low levels of air pollution

Accountability Studies

We request HEI conducts work documenting the reductions in emissions from light-duty vehicles since the 1960s and the associated health benefits. HEI should document how most of the traffic related emissions come from the older vehicles and the contributions of non-traffic sources to health impacts in the U.S. The documentation should include criteria pollutants, precursors, and MSATs.

Impacts of exposure to low levels of air pollution

We request HEI investigations of health impacts of exposure to the current and to the future low levels of pollutants in urban areas in U.S. We request help in understanding:

(i) the root cause(s) of conflicting and/or physically implausible results in the literature.

(ii) whether uncertainties are being systematically underestimated?

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Air Pollution and Mortality in the Medicare Population

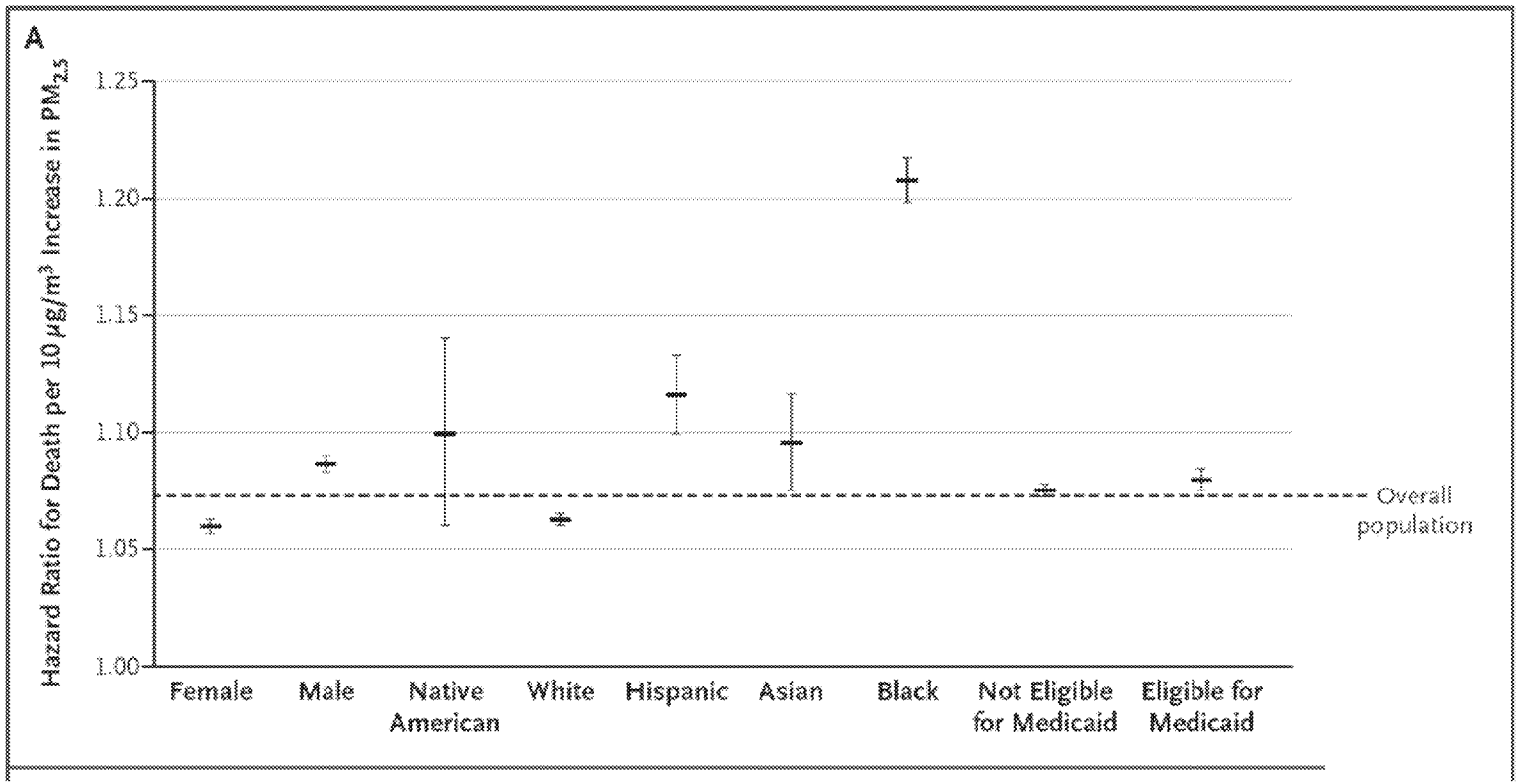
Qian Di, M.S., Yan Wang, M.S., Antonella Zanobetti, Ph.D., Yun Wang, Ph.D., Petros Koutrakis, Ph.D., Christine Choirat, Ph.D., Francesca Dominici, Ph.D., and Joel D. Schwartz, Ph.D.

"Increases of 10 μg per cubic meter in PM2.5 and of 10 ppb in ozone were associated with increases in all-cause mortality of 7.3% (95% confidence interval [CI], 7.1 to 7.5) and 1.1% (95% CI, 1.0 to 1.2), respectively".

Is it reasonable to conclude that after allowing for all other factors affecting mortality, and difficulties in assessing exposures, that with 95% confidence limits an additional 10ug/m^3 of ambient PM2.5 increases all-cause mortality by (7.3±0.2)%

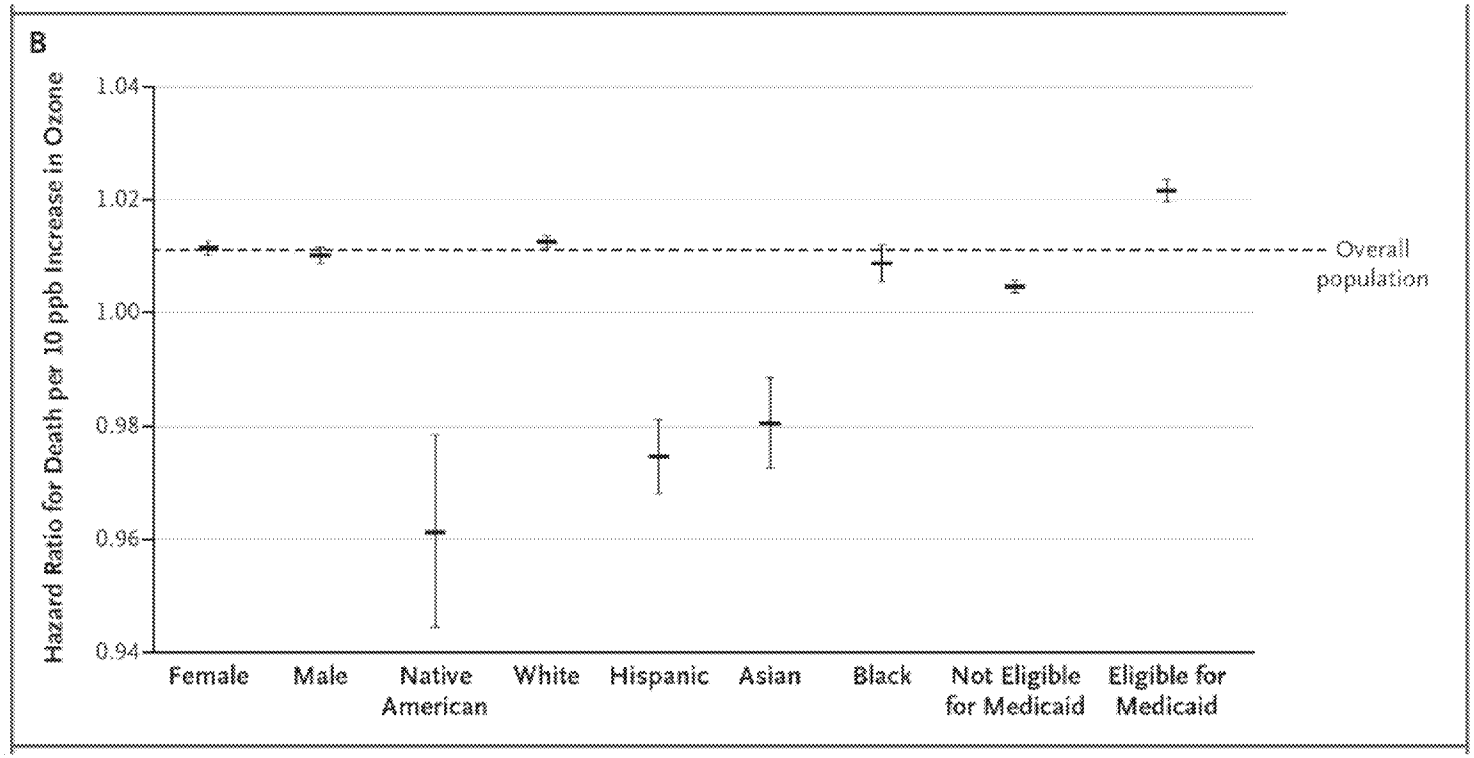
Ambient PM is complex mixture (sulfate/nitrate/organic/soot/mineral dust/sea salt/brake dust/road wear …) is it reasonable to lump them together? Root cause of health impacts?

Are uncertainties being systematically underreported?



Source: Di et al. (2017)

Lower socioeconomic status groups have greater health impacts when exposed to PM2.5 even when the analysis has accounted for other factors that affect health. Either the study does not properly account for these other factors, or there is an intrinsic physiological difference between different socioeconomic groups.

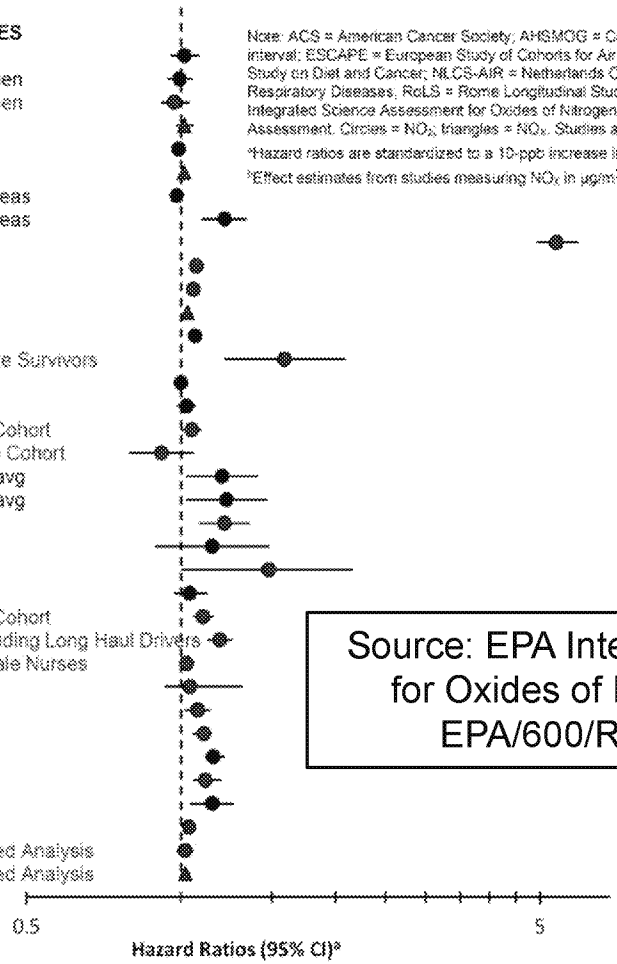


Source: Di et al. (2017)

Substantial health benefit of ozone exposure for Native Americans, Hispanics, and Asians?

ASSOCIATION BETWEEN LONG-TERM EXPOSURE TO OXIDES OF NITROGEN AND TOTAL MORTALITY

STUDY	COHORT	MEAN CONCENTRATION	NOTES
Abbey et al. (1999)	AHSMOG	36.7	Men
	AHSMOG	36.7	Women
Lipsett et al. (2011)	CA Teachers	33.6	Women
Krewski et al. (2000)	ACS	27.9	
Cao et al. (2011)b	China National Hypertension	50	
Filleul et al. (2005)	PAARC	24.5	24 areas
			18 areas
Zhang et al. (2011)	Shenyang, China	24.4	
Cesaroni et al. (2012)	RoLS	23.3-24.2	
Cesaroni et al. (2013)	RoLS	23.4	
Tonne and Wilkinson (2013)b	U.K.	22.6	
Lipfert et al. (2000)	Veterans	21.5-27.8	
Maheswaran et al. (2010)	South London Stroke	21.5	Stroke Survivors
Pope et al. (2002)	ACS -Extended	21.4-27.9	
Lipfert et al. (2006b)	Veterans	19.8-27.2	
Brunekreef et al. (2009)	NLCS-AIR	20.7	Full Cohort
			Case Cohort
Gehring et al (2006)	German Women's Health	20.7	1-yr avg
			5-yr avg
Heinrich et al. (2013)	German Women's Health	20.7	
Hoek et al. (2002)	NLCS	19.5	
Jerrett et al. (2009)	Toronto , Canada	19.5	
Lipfert et al. (2006a)	Veterans	16.3	
Hart et al. (2011)	TrIPS	14.2	Full Cohort
			Excluding Long Haul Drivers
Hart et al. (2013)	Nurses Health Study	13.9	Female Nurses
Yorifuji et al. (2010)	Shizuoka Elderly	13.3	
Jerrett et al. (2013)	ACS-CA	12.3	
Carey et al. (2013)	England, U.K.	11.9	
Nafstad et al. (2004)	Oslo, Norway, men	10.6	
Tonne and Wilkinson (2013)	U.K.	10; 6.6	
Krewski et al. (2000)	HSC-Re-analysis	6.1-21.9	
Lipfert et al. (2009)	Veterans	5.58	
Beelen et al. (2014a)	ESCAPE	2.8-31.7	Pooled Analysis
Beelen et al. (2014a)b	ESCAPE	8.7-107.3	Pooled Analysis



Note: ACS = American Cancer Society; AHSMOG = California Seventh-Day Adventists Cohort; CA = California; CI = confidence interval; ESCAPE = European Study of Cohorts for Air Pollution Effects; HSC = Harvard Six Cities; NLCS = Netherlands Cohort Study on Diet and Cancer; NLCS-AIR = Netherlands Cohort Study on Air Pollution and Mortality; PAARC = Air Pollution and Chronic Respiratory Diseases; RoLS = Rome Longitudinal Study; TrIPS = Trucking Industry Particle Study. Black = studies from the 2006 Integrated Science Assessment for Oxides of Nitrogen; Red = recent studies and those not included in 2008 Integrated Science Assessment. Circles = NO_2; triangles = NO_x. Studies are presented in descending order of mean concentration.

[a]Hazard ratios are standardized to a 10-ppb increase in NO_2 and a 20-ppb increase in NO_x concentration.

[b]Effect estimates from studies measuring NO_x in $\mu g/m^3$ are not standardized.

Source: EPA Integrated Science Assessment for Oxides of Nitrogen – Health Criteria, EPA/600/R-15/068, January 2016

Conflicting results from epidemiological studies of long-term health impacts even from same authors! Most recent study in Europe (Beelen et al. 2014) finds no discernable effect.

ASSOCIATION BETWEEN LONG-TERM EXPOSURE TO OXIDES OF NITROGEN AND TOTAL MORTALITY

"For NO_2, all-cause (natural) mortality is considered in ages above 30, for concentrations above 20 µg/m^3, assuming an increase in the risk of mortality of 5.5% for a 10 µg/m^3 increase of NO_2" (Air quality in Europe — 2018 report, EEA Report No 12/2018)

Table 10.1 Premature deaths attributable to $PM_{2.5}$, NO_2 and O_3 exposure in 41 European countries and the EU-28, 2015

		$PM_{2.5}$		NO_2		O_3	
Country	Population (1 000)	Annual mean (a)	Premature deaths (b)	Annual mean (a)	Premature deaths (b)	SOMO35 (a)	Premature deaths (b)
Austria	8 576	13.3	5 900	19.8	1 200	6 170	380
Belgium	11 237	13.0	7 400	20.9	1 500	2 790	220
Bulgaria	7 202	24.1	14 200	16.1	640	4 180	350
Croatia	4 225	17.4	4 500	17.3	430	6 240	230
Cyprus	1 173	16.9	750	14.1	30	6 390	40
Czechia	10 538	17.0	10 100	16.6	490	5 560	460
Denmark	5 660	9.7	2 800	10.5	80	2 200	90
Switzerland	8 238	11.8	4 200	21.4	1 000	6 170	300
EU-28	**506 030**	**13.9**	**391 000**	**18.9**	**76 000**	**4 250**	**16 400**
Total	**538 278**	**14.1**	**422 000**	**18.8**	**79 000**	**4 310**	**17 700**

2018 EU report claims 76000 premature deaths from NO_2 exposure.

HEALTH IMPACT NO2: EPIDEMIOLOGY AND TOXICOLOGY

Effects of long-term exposure to air pollution on natural-cause mortality: an analysis of 22 European cohorts within the multicentre ESCAPE project

Rob Beelen, Ole Raaschou-Nielsen, Massimo Stafoggia, Zorana Jovanovic Andersen, Gudrun Weinmayr, Barbara Hoffmann, Kathrin Wolf, Evangelia Samoli, Paul Fischer, Mark Nieuwenhuijsen, Paolo Vineis, Wei W Xun, Klea Katsouyanni, Konstantina Dimakopoulou, Anna Oudin, Bertil Forsberg, Lars Modig, Aki S Havulinna, Timo Lanki, Anu Turunen, Bente Oftedal, Wenche Nystad, Per Nafstad, Ulf De Faire, Nancy L Pedersen, Claes-Göran Östenson, Laura Fratiglioni, Johanna Penell, Michal Korek, Göran Pershagen, Kirsten Thorup Eriksen, Kim Overvad, Thomas Ellermann, Marloes Eeftens, Petra H Peeters, Kees Meliefste, Meng Wang, Bas Bueno-de-Mesquita, Dorothea Sugiri, Ursula Krämer, Joachim Heinrich, Kees de Hoogh, Timothy Key, Annette Peters, Regina Hampel, Hans Concin, Gabriele Nagel, Alex Ineichen, Emmanuel Schaffner, Nicole Probst-Hensch, Nino Künzli, Christian Schindler, Tamara Schikowski, Martin Adam, Harish Phuleria, Alice Vilier, Françoise Clavel-Chapelon, Christophe Declercq, Sara Grioni, Vittorio Krogh, Ming-Yi Tsai, Fulvio Ricceri, Carlotta Sacerdote, Claudia Galassi, Enrica Migliore, Andrea Ranzi, Giulia Cesaroni, Chiara Badaloni, Francesco Forastiere, Ibon Tamayo, Pilar Amiano, Miren Dorronsoro, Michail Katsoulis, Antonia Trichopoulou, Bert Brunekreef, Gerard Hoek

Beelen et al. Lancet (2014)

Meta-study of 22 European cohort studies with total study population of 367,251

Large study in Europe, most recent study, comprehensive engagement of European epidemiological community, effort to account for confounding factors

	Number of cohorts	Model 1*	Model 2*	Model 3*
$PM_{2.5}$	19‡	1·18 (1·08–1·30)	1·09 (1·03–1·14)	1·07 (1·02–1·13)
$PM_{2.5}$ absorbance	19‡	1·11 (1·04–1·18)	1·04 (0·99–1·09)	1·02 (0·97–1·07)
PM_{10}	19‡	1·12 (1·03–1·21)	1·05 (1·01–1·10)	1·04 (1·00–1·09)
PM_{coarse}	19‡	1·14 (1·03–1·26)	1·05 (0·99–1·12)	1·04 (0·98–1·10)
NO_2	22	1·06 (1·02–1·10)	1·02 (0·99–1·04)	1·01 (0·99–1·03)
NO_x	22	1·06 (1·03–1·09)	1·03 (1·00–1·05)	1·02 (1·00–1·04)

Model 1 was adjusted for sex and calendar time; model 2 was adjusted as in model 1, but also adjusted for smoking status, smoking intensity, smoking duration, environmental tobacco smoke, fruit intake, vegetables intake, alcohol consumption, body-mass index (BMI), educational level, occupational class, employment status, and marital status; and model 3 was adjusted as in model 2 but also adjusted for area-level socioeconomic status.

Latest study in Europe (Beelen et al. 2014) finds **no** discernable effect of long-term exposure to ambient NO_2 on mortality.

Thank you